In This Issue

Fall Applied Herbicides And Winter Weed Control

(Marcelo Zimmer) & *(Bill Johnson)*

As harvest season progresses quickly this fall due to favorable weather conditions and our crops come out of the field, now is the time to think about weed control for winter annual weeds, including marestail. When harvest and post-harvest conditions allow, fall is the best time to control many of these weeds. This is because the weeds are a lot smaller in the fall, and our fall weather tends to be consistently warmer and drier than our variable cool and wet springs. With fall applied herbicide season upon us, we wanted to provide a few application tips to those who are in the process of making fall herbicide applications.

1) Scout fields and determine whether you need an application. Not all fields need an application, however, if you pull back the crop residue, especially in corn fields, you are likely to find infestations of winter weeds. Scouting fields should begin soon after a field is harvested, with special attention paid to fields with heavy infestations of marestail this year.

2) One of our biggest weed problems across Indiana every year is marestail control in soybeans, and 2020 has been no different. Many growers struggle to control marestail in their spring burndown programs in April and May, especially in fields infested with fall emerged marestail. Marestail size greatly reduces the effectiveness of synthetic auxin herbicides such as 2,4-D and dicamba and fall emerged plants may be over a foot tall by the time weather conditions allow for spring herbicide applications (Figure 1). This highlights the importance of using a fall applied herbicide program to control marestail and other winter annual weeds. We also have known cases of glyphosate and ALS-resistant marestail in most counties in Indiana and we have noticed a substantial number of fields with marestail in them late this summer that either were not controlled by postemergence herbicides or emerged after postemergence herbicides were applied. It would be wise to treat fields with marestail with a combination of dicamba and 2,4-D as part of the fall herbicide program. Fields that are harvested early would benefit with the addition of 4 to 6 ounces of metribuzin to provide residual control of marestail this fall until the ground freezes. This residual will not last into the spring, but will help with late-fall emerging plants. Fields harvested in late October or November may not need metribuzin unless it stays warm late into the fall.

3) The best time to apply herbicides in the fall is on days when the morning low is above freezing. The best foliar herbicide activity will occur when you have a few days of warm daytime air temperatures (50's or higher) and applications are made in the middle of this period. If fall applied herbicides are needed, one should not leave the sprayer in the shed if daytime temperatures do not get into the 50's. Just remember that the speed of foliar activity of systemic herbicides like glyphosate and 2,4-D is less in cool conditions. In these conditions, it would be advisable to use residual products tank-mixed with the foliar products to provide residual activity for periods when weather conditions might allow additional weed emergence.

4) There are pockets across the state that also deal with heavy infestation of dandelions every year (Figure 2). Dandelions are controlled much more effectively with fall applied programs than with spring applied herbicides. Dandelions can be controlled with fall applications of 2,4-D or a glyphosate product. Use a minimum of 1 qt/A of 4 lb/gallon 2,4-D products and 1 qt/A (0.75lb ae/A) of a glyphosate product. Once we have had a couple of hard frosts, the dandelions may be a litter tougher to control, so don't rely on reduced rates.

5) In fields with heavy corn residue, increase spray volume or decrease speed to increase carrier volume. Many weeds will be shielded by residue, so spray coverage can be compromised. In addition, use of residual products in these situations will increase the consistency of winter weed control because these products can be washed off of the corn residue with precipitation and into the soil where they can be effective.

Figure 1. A fall emerging marestail plant that reached 1-ft. in height by May 13, 2015. Herbicide applications would have marginal results at best on this size of marestail plant.

Figure 2. Flowering dandelions in no-till corn stubble.

Reduce The Fear – Managing Prussic Acid In Sorghum

(Keith Johnson)

The calls, texts and emails began late last week and continued on Monday. The contacts were occurring because temperature early Monday morning was projected to be around 32°F in some areas of the state. Livestock producers wanted to know more about the risk of prussic acid poisoning when members of the sorghum family (sudangrass, sorghum-sudangrass, and forage sorghum, and Johnsongrass present in pastures) are being utilized after a freeze event. The video produced discusses how to manage prussic acid in sorghums.

Another potential concern for individuals in Indiana where sorghum was stressed by drought conditions is nitrate content. When samples are being sent to a forage testing laboratory for quality analysis, it would be prudent to request a nitrate test if you were in a very dry in the late summer and early fall.

Sorghum-sudangrass suffered freeze damage this past weekend in some areas of Indiana. Prussic acid poisoning potential can be minimized with management. (Photo Credit: Keith Johnson)

Frost And Hemp, Should Growers Worry?

(Marguerite Bolt, mbolt@purdue.edu)

We had some chilly nights last weekend and the beginning of the week, which caused concern for some hemp growers. But, we made it through and the hemp seems to be doing alright. There are some noticeable changes in color, which could cause alarm, other than that, the hemp is unscathed. One cultivar at Meigs went from a bright green to a deep purple. The same thing happens to the forsythia in my front yard and to many other plants this time of year.

Most of the data on frost tolerance and hemp is out of Canada and focuses on grain and fiber specific cultivars. Growers have harvested all the fiber hemp and most of the grain hemp. However, there is not much data on frost tolerance in cannabinoid rich hemp. The University of Vermont does have some useful information on their experiences with frost and hemp. They find that mature plants can handle frost temperatures of 29-32°F, but a moderate freeze of 25-28° can damage some vegetation, and temperatures of 24°F or colder can cause heavy damage to plants (UVM Hemp and Cold Temperatures). They do not discuss duration of cold temperatures or cultivar differences, but it gives us a helpful starting point to better understand frost tolerance. They also believe that frost and the change in color does not necessarily mean a change in cannabinoid content. One Indiana grower has noticed that purple hemp plants are more likely to fade to a brown color once harvested and stored compared with hemp that was harvested green. There is not a degradation in quality, but the color could worry some growers.

What is interesting about the hemp at Meigs, are the two cannabinoid hemp cultivars reacted differently to the frost. The cultivar Eclipse turned a deep purple color and appears to be unharmed by the frost. The other cultivar, Cherry Wine, did not turn purple or red and also appears to be unharmed. It is possible that Cherry Wine will not change color during a frost, or that it will take much colder temperatures to change it. According to the weather data from TPAC, the coldest it got was 32°F and it was not cold for long. The two week forecast does not show temperatures dipping below freezing, so for growers who are still waiting to harvest, it does not look like you have to worry about frost damage.

Hemp at Meigs on Oct. 1 (*C. sativa* 'Eclipse').

Hemp at Meigs on Oct. 8 (*C. sativa* 'Eclipse').

Hemp at Meigs on Oct. 8 (*C. sativa* 'Cherry Wine').

Purdue Crop Chat Episode 10, Strong Early Yields

(Bob Nielsen) & *(Shaun Casteel)*

In the latest Purdue Crop Chat Podcast, Extension Corn Specialist Bob Nielsen and Extension Soybean Specialist Shaun Casteel discuss early yield numbers that they're hearing from farmers and getting on their own research trials.

They also discuss their expectations of the October 9 USDA Crop Report.

The Purdue Crop Chat Podcast is presented by the Indiana Corn Marketing Council and the Indiana Soybean Alliance.

Grain Test Weight Considerations For Corn

(Bob Nielsen)

Among the top 10 most discussed (and cussed) topics at the Chat 'n Chew Cafe during corn harvest season is the grain test weight being reported from corn fields in the neighborhood. Test weight is measured in the U.S. in terms of pounds of grain per volumetric "Winchester" bushel. In practice, test weight measurements are based on the weight of grain that fills a quart container (37.24 qts to a bushel) that meets the specifications of the USDA-AMS (FGIS) for official inspection (Fig. 1). Certain electronic moisture meters, like the Dickey-John GAC, estimate test weight based on a smaller-volume cup. These test weight estimates are reasonably accurate but are not accepted for official grain trading purposes.

Fig. 1. A standard filling hopper and stand for the accurate filling of quart or pint cups for grain test weight determination. (Image: www.seedburo.com).

The official minimum allowable test weight in the U.S. for No. 1 yellow corn is 56 lbs/bu and for No. 2 yellow corn is 54 lbs/bu (USDA-AMS (FGIS), 1996). Corn grain in the U.S. is marketed on the basis of a 56-lb "bushel" regardless of test weight. Even though grain moisture is not part of the U.S. standards for corn, grain buyers pay on the basis of "dry" bushels (15 to 15.5% grain moisture content) or discount the market price to account for the drying expenses they expect to incur handling wetter corn grain.

Growers worry about low test weight because local grain buyers often discount their market bids for low test weight grain. In addition, growers are naturally disappointed when they deliver a 1000 bushel (volumetric bushels, that is) semi-load of grain that averages 52-lb test weight because they only get paid for 929 56-lb "market" bushels (52,000 lbs ÷ 56 lbs/bu) PLUS they receive a discounted price for the low test weight grain. On the other hand, high test weight grain makes growers feel good when they deliver a 1000 bushel semi-load of grain that averages 60 lb test weight because they will get paid for 1071 56-lb "market" bushels (60,000 lbs ÷ 56 lbs/bu).

These emotions encourage the belief that high test weight grain (lbs of dry matter per volumetric bushel) is associated with high grain yields (lbs. of dry matter per acre) and vice versa. However, there is little evidence in the research literature that grain test weight is strongly related to grain yield.

Hybrid variability exists for grain test weight, but does not automatically correspond to differences in genetic yield potential. Grain test weight for a given hybrid often varies from field to field or year to year, but does not automatically correspond to the overall yield level of an environment.

Similarly, **grain from high yielding fields does not necessarily have higher test weight than that from lower yielding fields**. In fact, test weight of grain harvested from severely stressed fields is occasionally higher than that of grain from non-stressed fields, as evidenced in Fig. 2 for 27 corn hybrids grown at 3 locations with widely varying yield levels in Kansas in 2011. Another example from Ohio with 22 hybrids grown in common in the drought year of 2012 and the much better yielding year of 2013 also indicated no relationship between yield level and grain test weight (Fig. 3).

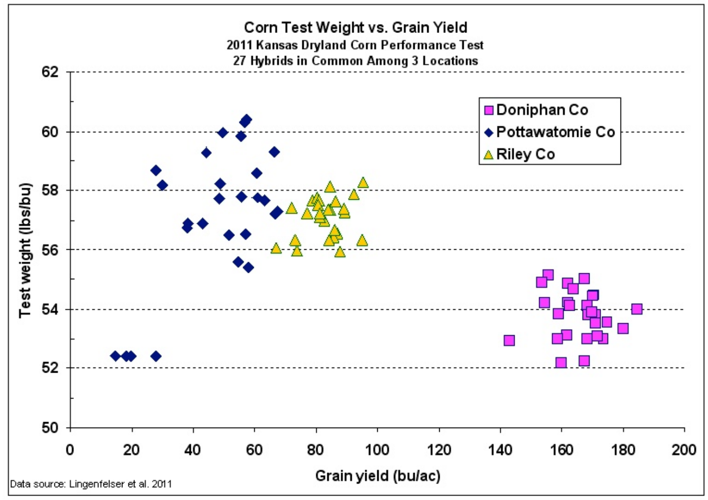


Fig. 2. Corn grain test weight versus grain yield for 27 hybrids grown at 3 Kansas locations (Lingenfelser et al, 2011).

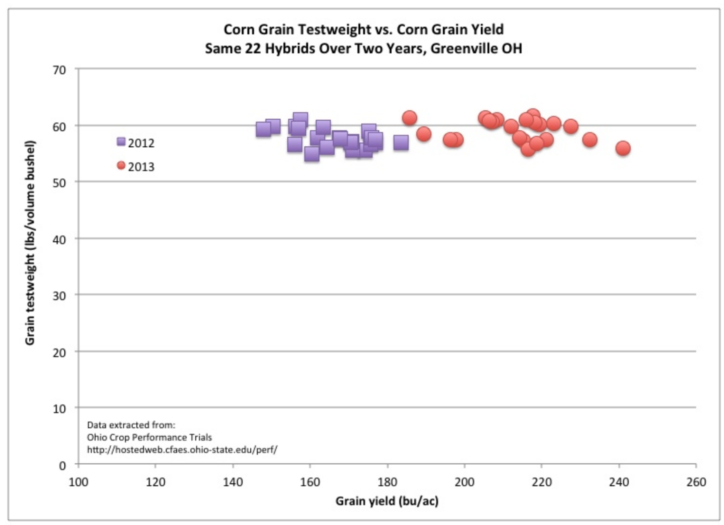


Fig. 3. Corn grain test weight versus grain yield for 22 hybrids grown at Greenville, OH in 2012 (drought) and 2013 (ample rainfall).

Conventional dogma suggests that low test weight corn grain decreases the processing efficiency and quality of processed end-use products like corn starch (U.S. Grains Council, 2020), although the research literature does not consistently support this belief. Similarly, low test corn grain is often thought to be inferior for animal feed quality, although again the research literature does not support this belief (Laborie, 2019; Rusche, 2020; Simpson, 2000; Wiechenthal Pas et al., 1998). Whether or not low test weight grain is inferior to higher test weight grain may depend on the cause of the low test weight in the first place.

Common Causes of Low Grain Test Weight

The 2009 corn harvest season in Indiana (late crop maturation, late harvest) was an example of one where there were more reports of low test weight corn grain than good or above average test weights. There were primarily six factors that accounted for most of the low test weight grain in 2009 and four shared a common overarching effect.

Grain Moisture

First and foremost, growers should understand that **test weight and grain moisture are inversely related**. The higher the grain moisture, the lower the test weight AT THAT POINT IN TIME. As grain dries in the field or in the dryer, test weight naturally increases as long as kernel integrity remains intact. Test weight increases as grain dries partly because kernel volume tends to shrink with drying and so more kernels pack into a volume bushel and partly because drier grain is slicker which tends to encourage kernels to pack more tightly in a volume bushel. Therefore in a year like 2009 with many of the initial harvest reports of grain moisture ranging from 25 to 30% instead of the usual starting moisture levels of about 20 to 23%, it should not be surprising that test weights were lower than expected.

Hellevang (1995) offered a simple formula for estimating the increase in test weight with grain drying. In its simplest form, the equation is (A / B) x C; where A = 100 – dry moisture content, B = 100 – wet moisture content, and C = test weight at wet moisture content. The author does not say, but I suspect this simple formula is most applicable within a "normal" range of harvest moistures; up to moistures in the mid- to high 20's.

Example: Dry moisture = 15%, Wet moisture = 25%, Test weight at 25% = 52 lbs/bu.

Estimated test weight at 15% moisture = ((100 – 15) / (100 – 25)) x 52 = (85/75) x 52 = 58.9 lbs/bu

An older reference (Hall & Hill, 1974) offers an alternative suggestion for adjusting test weight for harvest moisture that also accounts for the level of kernel damage in the harvested grain (Table 1). The table values are based on the premise that kernel damage itself lowers test weight to begin with and that further drying of damaged grain results in less of an increase in test weight that what occurs in undamaged grain. Compared to the results from using Hellevang's simple formula, adjustments to test weight using these tabular values tend to result in smaller adjustments to test weight for high moisture grain at harvest, but larger adjustments for drier grain at harvest.

Table 1. Adjustment added to the wet-harvest test weight to obtain an expected test weight level after drying to 15.5 percent moisture.

	Grain moisture at harvest (percent)							
Percent Damage	**30**	**28**	**26**	**24**	**22**	**20**	**18**	**16**
45	0.3							
40	0.7	0.2						
35	1.3	0.7						
30	1.8	1.3	0.8					
25	2.4	1.9	1.4	0.9	0.3			
20	3.1	2.6	2.0	1.5	1.0	0.5		
15	3.8	3.2	2.7	2.2	1.7	1.2	0.6	0.2
10	4.5	4.0	3.5	2.9	2.2	1.9	1.4	0.8
5	5.3	4.7	4.2	3.7	3.0	2.7	2.1	1.6
0	6.1	5.6	5.0	4.5	4.0	3.5	2.9	2.4

Stress During Grain Fill

Secondly, **thirdly**, and **fourthly**; drought stress, late-season foliar leaf diseases (primarily gray leaf spot and northern corn leaf blight), and below normal temperatures throughout September of 2009 all resulted in a significant deterioration of the crop's photosynthetic machinery beginning in early to mid-September that "pulled the rug out from beneath" the successful completion of the grain filling period in some fields; resulting in less than optimum starch deposition in the kernels. **Fifthly**, early October frost/freeze damage to late-developing, immature fields resulted in leaf or whole plant death that effectively put an end to the grain-filling process with the same negative effect on test weight.

Ear Rots

Finally, ear rots (diplodia, gibberella, etc.) were widespread throughout many areas of Indiana in 2009. Kernel damage by these fungal pathogens results in light-weight, chaffy grain that also results in low test weight diseased grain, broken kernels, and excessive levels of foreign material. This cause of low test weight grain obviously results in inferior (if not toxic) animal feed quality grain, unacceptable end-use processing consequences (ethanol yield, DDGS quality, starch yield and quality, etc.), and difficulties in storing the damaged grain without further deterioration.

Related reading

Bern, Carl and Thomas Brumm. 2009. Grain Test Weight Deception. Iowa State Extension Publication PMR-1005. http://www.extension.iastate.edu/Publications/PMR1005.pdf. [URL accessed Oct 2020].

Bradley, Carl. 2009. Diplodia Ear Rot Causing Problems in Corn Across the State. The Bulletin, Univ of Illinois Extension. http://ipm.illinois.edu/bulletin/article.php?id=1233. [URL accessed Oct 2020].

Hall, Glenn and Lowell Hill. 1974. Test Weight Adjustment Based on Moisture Content and Mechanical Damage of Corn Kernels. Trans. ASAE 17:578-579.

Hellevang, Kenneth. 1995. Grain Moisture Content Effects and Management. North Dakota State Extension Publication AE-905. http://www.ag.ndsu.edu/extension-aben/documents/ae905.pdf. [URL accessed Oct 2020].

Hellevang, Kenneth. 2019. Many Factors Influence Corn Test Weight. North Dakota State Univ. Extension. https://www.ag.ndsu.edu/news/newsreleases/2019/nov-25-2019/many-factors-influence-corn-test-weight [URL accessed Oct 2020]

Hicks, D.R. and H.A. Cloud. 1991. Calculating Grain Weight Shrinkage in Corn Due to Mechanical Drying. Purdue Extension Publication NCH-61 http://www.ces.purdue.edu/extmedia/nch/nch-61.html [URL accessed Oct 2020].

Hill, Lowell D. 1990. Grain Grades and Standards: Historical Issues Shaping the Future. Univ. of Illinois Press, Champaign, IL.

Hurburgh, Charles and Roger Elmore. 2008. Corn Quality Issues in 2008 – Moisture and Test Weight. Integrated Crop Management News, Iowa State Univ. Extension. https://crops.extension.iastate.edu/cropnews/2008/10/corn-quality-issues-2008-moisture-and-test-weight. [URL accessed Oct 2020].

Hurburgh, Charles and Roger Elmore. 2008. Corn Quality Issues in 2008 – Storage Management. Integrated Crop Management News, Iowa State Univ. Extension. https://crops.extension.iastate.edu/cropnews/2008/10/corn-quality-issues-2008-�-storage-management. [URL accessed Oct 2020].

Laborie, Erin. 2019. Feeding Light Test Weight Corn in Growing and Finishing Diets. Univ. of Nebraska Extension. https://beef.unl.edu/beefwatch/feeding-light-test-weight-corn-growing-a nd-finishing-diets [URL accessed Oct 2020]

Lingenfelser, Jane (sr. author). 2011. Kansas Crop Performance Tests with Corn Hybrids (SRP1055). Kansas State University Agricultural Experiment Station and Cooperative Extension Service, Kansas State Univ.

Nafziger, Emerson. 2003. Test Weight and Yield: A Connection? The Bulletin, Univ of Illinois Extension. http://ipm.illinois.edu/bulletin/pastpest/articles/200323h.html. [URL accessed Oct 2020].

Rankin, Mike. 2009. Understanding Corn Test Weight. Univ Wisconsin Extension. https://fyi.uwex.edu/grain/files/2009/12/CornTW09.pdf. [URL accessed Oct 2020]

Rusche, Warren. 2020. Feeding Value of Light-Test Weight Corn. iGrow, South Dakota State Univ Extension. https://extension.sdstate.edu/feeding-value-light-test-weight-corn [URL accessed Oct 2020]

Simpson, Greg. 2000. Summary of Research on Feeding Low Test Weight Corn to Pigs. Ontario Ministry of Ag, Food, and Rural Affairs. http://www.omafra.gov.on.ca/english/livestock/swine/facts/info_n_summary.htm [URL accessed Oct 2020]

USDA-AMS (FGIS). Sep 1996. Subpart D of U.S. Standards for Corn. U.S. Standards. U.S. Department of Agriculture – Agricultural Marketing Service (Federal Grain Inspection Service). https://www.ams.usda.gov/sites/default/files/media/CornStandards.pdf. [URL accessed Oct 2020].

USDA-AMS (FGIS). Oct 2020. Grain Inspection Handbook, Book II: Grain Grading Procedures. United States Department of Agriculture – Agricultural Marketing Service (Federal Grain Inspection Service). https://www.ams.usda.gov/sites/default/files/media/Book2.pdf [URL accessed Oct 2020]

USDA-AMS (FGIS). [date unknown]. Test Weight per Bushel. *in* Corn Grading Tutorial. United States Department of Agriculture – Agricultural Marketing Service (Federal Grain Inspection Service). https://apps.ams.usda.gov/elearning/Grading/Grading_Corn/presentation_html5.html. [URL accessed Oct 2020].

U.S. Grains Council. 2020. Test Weight. *in* Corn Export Cargo Quality Report 2019/2020. U.S. Grains Council. https://grains.org/corn_report/corn-harvest-quality-report-2019-2020/4/ [URL accessed Oct 2020]

Weichenthal Pas, B.A., I.G. Rush, B.G. Van Pelt, A.D. Howes, and J.R. Males. 1998. Light-Test Weight Corn for Growing and Finishing Steers. The Professional Animal Scientist, Vol. 14, Issue 2, pp. 114-117. Elsevier, Inc. http://www.sciencedirect.com/science/article/pii/S1080744615318040 [URL accessed Oct 2020]

Woloshuk, Charles and Kiersten Wise. 2009. Diplodia Ear Rot. Purdue Extension Publication #BP-75-W. https://www.extension.purdue.edu/extmedia/BP/BP-75-W.pdf. [URL accessed Oct 2020].

Post-Harvest Grain Management Strategies For The Fall

(Klein Ilelji)

Harvest is already underway in the Midwest with 22% of corn and 30% of soybean already harvested in Indiana by October 4 according to USDA-NASS crop progress report (USDA, 2020). It appears that the yields this year would be fairly good and farmers would be bringing in a good crop. This article focuses on securing the crop by ensuring that grain is harvested timely, dried adequately and binned correctly.

Harvest grain timely and dry adequately for safe storage

First of all, it is important to know what moisture content you need to be storing your grain at based on your short and long-term marketing plans. How long you intend to store your grain will determine the level of moisture content to dry your grain to. Table 1 provides a guideline on recommended maximum moisture contents at storage periods from up to 6 months to over one year for various grain types. Note that the longer you intend to hold your grain, the lower the level of moisture you need to be. This is very important especially if you would be storing your grain through the warm summer months, when managing grain becomes more challenging, and the potential for insect pests and mold problems increases. Please note the caveat below the table headline – *reduce safe storage moisture content by 1% for poor quality grain.*

Table 1. Maximum moisture contents for grain harvest and safe storage recommended in the Midwest. (Source: Grain Drying, Handling and Storage handbook, third edition, MWPS-13). ***Values for good quality, clean grain and aerated storage. Reduce safe storage moisture content by 1% for poor quality grain.***

	Maximum Moisture Content, %wb			
		Storage Period		
Grain Type	**At Harvest**	**Up To 6 Months***	**6-12 Months****	**>1 Year****
Shelled corn and grain sorghum	30	15	13	13
Soybeans	18	13	12	11
Wheat, barley and oats	20	14	13	12
Flaxseed	15	9	7	7
Canola	14	9	8	8
Sunflower	17	10	8	8
Edible beans	16	16	13	13

*Up to 6 months from harvest refers to storage under winter conditions.
**6-12 months and >1 year storage refers to storage into the warm summer months.

Harvesting grain timely after it matures on the field is important for ensuring the yields achieved is secured in the bin. Moisture content is one variable that drives the decision on when to harvest because it impacts the cost that would be incurred in artificially drying grain using a low-temperature or high-temperature dryer compared to leaving the grain to naturally dry-down on the field. Table 1 gives maximum recommended moisture for various grains and oilseeds at harvest. Most farmers will typically take advantage of good dry weather to allow corn and soybean to naturally dry-down on the field to below 25% and 15%, respectively, before they commence harvesting. However, since field dry-down is weather dependent, some years happen to be great for fall field drying, while others are not. There are other risks, which determine whether to harvest early such as an extreme weather event like a storm that could cause huge damages to crops. The risks/cost of leaving the crop on the field to dry-down rather than harvesting early and drying artificially needs to be considered. Also, the rate of field dry-down for grain reduces as day-time temperature drops as we progress into the fall. So for corn planted late that would be harvested late in the fall, there is only a little window to take advantage of field dry-down. Additionally, make sure combine harvesters are adjusted to bring in clean grain, which helps grain handling through drying and storage. Excessive thrash/pods harvested with corn/soybean are a potential fire hazard when drying using high-temperature dryers, especially when thrash is allowed to accumulate in dryers. Routine cleaning of thrash from grain dryers is adviced (for example weekly).

Drying and cooling grain

Natural air (NA) or low temperature (LT) air (aeration with the addition of heat, 5 to 10°F) in-bin drying is recommended if corn and soybean are harvested below 20% and 15% moistures, respectively, especially when harvested early in the fall when ambient daytime temperatures are still in the 60 to 70°F range. Otherwise, consider using a high temperature dryer (180°F or more air temperature), especially for higher moistures so that grain is dried as quickly as possible to prevent the onset of spoilage in a wet holding bin. Shallower grain fill depths or larger diameter bins favor in-bin drying because the drying front has less depth to move through compared to a narrower and taller bin. Having adequate airflow (cfm/bu) by properly using an adequately sized fan is key to successfully using NA/LT systems for drying as well as for aeration. The higher the airflow, the better the system. An airflow of 1.5 cfm/bu is recommended for use in NA/LT in-bin systems for grain in Indiana. For soybean, care needs to be taken to dry in order to prevent split beans. Ensure that drying air humidity levels are not below 40% when drying soybean with medium (120-140°F) or high-temperatures (160-180°F).

For both corn and soybean, ensure that adequate aeration is applied to grain using natural air after drying. Aeration is not intended for drying grain, but rather for lowering grain temperature (cooling) in order to prevent spoilage. Neverthless, a little bit of moisture is removed from the grain during each aeration cycle (about 0.25 to 0.3 percentage points of moisture per 10°F temperature decrease). Airflow rates as low as 0.05 (1/20) cfm/bu to over 1 cfm/bu can be successfully used to cool down grain in the bin. In general, dividing 15 by the airflow rate gives an estimate of the hours required to change the temperature of the grain by aeration. For example, it'll take 150 hours of fan run time to change the temperature of corn having an airflow rate of 0.1 cfm/bu, and doubling the airflow rate to 0.2cfm/bu reduces the fan runtime by half (75 hours). The cold winter ambient temperatures provide a natural low cost means to preserve grain by chilling. Chilled grain can be held cold through the spring. Table 2 provides a guide on how to cool grain in step-wise phases through the fall-winter period. Dry binned grain can be cooled to below 32°F without any detrimental effects to the kernel integrity. Under cold grain conditions, insect pests are adequately controlled and in most cases killed during this period. Notice that grain should not be warmed up in the spring to ambient spring temperatures, but rather still kept cool. Additionally, during the warm spring period, the aeration fan's airflow intake should be covered to prevent warm air from re-warming the grain through the plenum. Should the grain in the bin still be cold during the time of loadout from the bin, it is advisable to warm up the grain to the ambient temperature prior to load out. This will prevent moisture from condensing on cold grain during loadout. Having temperature cables in the grain bulk, and or temperature/relative humidity (RH) sensors in the headspace and/or plenum depending on whether you have a positive pressure aeration system (pushing air from the plenum through grain) or a negative pressure aeration systems (pulling air from the headspace through grain) will enable the temperature front be monitored as it moves through the grain. The use of temperature/RH sensors is a good way to monitor the progress of the temperature front during aeration so that fans can be shut-off timely, and therefore energy used wisely.

Table 2. Recommended aeration phases after drying grain in the fall.

Aeration Phases After Drying Grain	
Phase 1: Fall Cool Down – Lower grain temperatures step wise • October – 40-45°F • November – 35-40°F • December – 28-35°F	Prevent re-warming grain during warm weather spells. Keep grain temperatures as low as possible.
Phase 2: Winter Maintenance – Maintain low temperatures with intermittent aeration: January, February – 28-35°F	Prevent re-warming grain during warm weather spells. Keep grain temperatures as low as possible.
Phase 3: Spring Holding – Keep grain cold from winter aeration • Seal fans • Ventilate only headspace intermittently	If grain in bin is cooler than the ambient, warm up grain to the ambient prior to load-out

Remove fines from the grain bulk core to facilitate aeration

Last but not the least is coring the bin during filling to prevent the accumulation of fines and brokens at the center of the grain mass, which could cause the onset of spoilage. Coring reduces the levels of fines and broken kernels, which lodge at the center of the bin during filling, and helps improve airflow through the grain bulk. A rule of thumb when coring a bin is to pull out 1/3 to 1/2 the bin diameter, so that you have an inverted cone at the surface (*See Figure 1*).

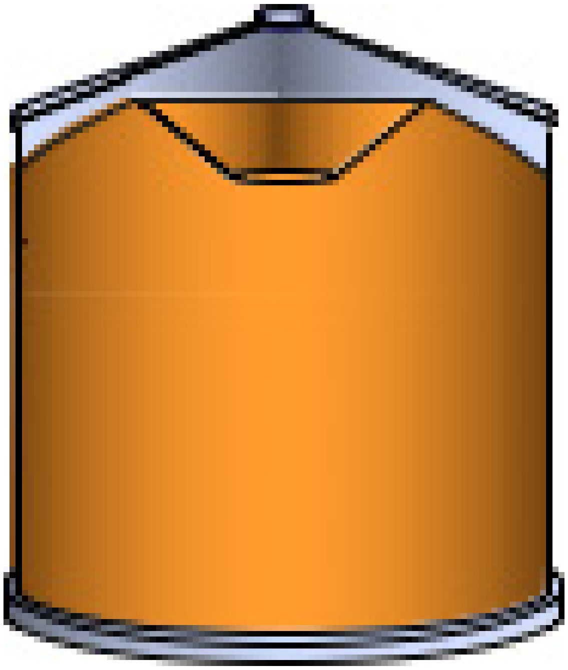


Figure 1. An illustration of a cored bin after the fines and broken corn has been pulled from the center, enabling better airflow during aeration (*Figure Credit: Dr. Sam McNeill, University of Kentucky*).

Ensure moisture meters used on the farm are calibrated prior to use. It is advisable to check your moisture meter calibration with the elevator you deliver grain to. This way ensures that the moisture content measured by your elevator when you deliver grain is close to what you would have measured prior to delivery. While you go about your harvest and work around your bins, remember to put safety first. Safety for your personnel and family members must never be compromised. In the busyness of the harvest season, remember to pause to think about whether you are going about your operations in a safe manner. Be safe!

References:

MWPS-13 Grain Drying, Handling and Storage Handbook, 2017. Third Edition Copyrigt @ 2017, Iowa State University/Midwest Plan Service.

USDA, 2020. Crop progress report. USDA-NASS report relaesd on October 5, 2020. ISSN: 1948-3007. Access online on October 7, 2020 at https://downloads.usda.library.cornell.edu/usda-esmis/files/8336h188j/gx41n7114/rr172n08t/prog4120.pdf

Maintenance Is Crucial To Prevent Combine Fires

(Edward Sheldon) & (Bill Field)

This article was originally published by Purdue Agricultural Communications, October 2016. Revised and updated by the Purdue Agricultural Safety & Health Program, September 2020.

Harvest 2020 in Indiana and other Midwestern states is starting very dry! Much of Indiana is currently rated as "abnormally dry" or even "moderate drought" and very little if any precipitation is in the near-term forecast. Combine fires cost farmers millions of dollars in damages every harvest, and in dry years such as 2020, the potential for fires is even greater than normal. In fact, the Purdue Agricultural Safety & Health program has already received reports of combine fires in Indiana. As harvest ramps up, be proactive and prevent or reduce the chance of combine fires before they happen!!

Farmers should regularly inspect their combines' machinery, fuel lines and electrical systems during harvest season to prevent fires, a Purdue Extension safety specialist says.

Harvest season brings a unique combination of risk factors that increases the risk of combine fires, said Bill Field, professor of agricultural and biological engineering. Dust kicked up during field operations and dry plant material from crops can clog or wrap around machinery, causing it to overheat. Other common hazards are electrical malfunctions, sparks from hitting rocks, loose or slipping belts and leaks in fuel or hydraulic lines.

Worn bearings or seals and blocked exhaust systems can cause overheating and sparks. Inspecting equipment at the end of the day can help prevent overheated components from catching fire during the night, Field said, and a hand-held thermal camera can help detect hot areas before they ignite.

Combine fires can be devastating, often resulting in the total loss of a vehicle and causing hundreds of thousands of dollars' worth of property damage, says Purdue University farm safety expert Bill Field.

Combine fires can escalate in seconds, so it is critical for farmers to carry cellphones or two-way radios to call for help if a fire occurs, Purdue University farm safety expert Bill Field says. (Photo courtesy of Andrew Winger/Winger Farms)

Combine fires can be devastating, often resulting in the total loss of a vehicle and causing hundreds of thousands of dollars' worth of property damage, says Purdue University farm safety expert Bill Field. (Photo courtesy of Andrew Winger/Winger Farms)

Some components of the combine's electrical systems are also at higher risk of overheating, particularly parts like starter motors and heating and cooling systems that draw a heavy electrical load. "Fuses that blow regularly should be considered an important warning sign that a circuit is overheating somewhere," Field said.

"Every fire involves three elements – an ignition source, fuel and oxygen. Removing one or more of these elements will prevent fire, so as you examine the combine, other agricultural machinery or a building, consider the potential for each element and where they are likely to come together to form a fire."

In case a fire does start, farmers should always have a cellphone or two-way radio with them in the cab. Also, combines and other large units should have at least two 10-pound, type ABC fire extinguishers installed, Field recommended. These extinguishers should be inspected regularly to make sure the lock pin is intact, tamper seals are unbroken and the tank is still full.

A second line of defense is to have a tractor and disc on standby to create a firebreak around the combine, Field added. This can help keep the flames from spreading across the field or to neighboring properties.

Since insulated cabs may prevent operators from noticing smoke or flames until it is too late, combine fires can start without warning and quickly grow out of control, Field said.

"Even small leaks in a fuel or hydraulic system can cause a small fire to become a large one in seconds," Field said. "For example, a leak causing diesel fuel to be sprayed into the engine compartment of a tractor or combine can cause the compartment temperature to go from a normal operating temperature to over 1,000 degrees Fahrenheit in seconds. Fires of that intensity are almost impossible to extinguish before the machine is destroyed."

In addition to damaging or destroying the combine, other consequences may include crop loss, field fires spreading to adjoining properties, and operator injury or death.

"Ultimately, the only good fire is a contained one that keeps us warm," said Field. "Keeping it that way in the field should be part of every farmer's management plan this fall."

Dryness Continues While A Strengthening La Niña More Likely For This Winter

(Beth Hall)

September was dry across Indiana with some counties being the driest on record since 1895 (Figure 1). Four counties – Owen, Morgan, Johnson, and Hendricks – experienced the driest September on record, with over 30 counties experiencing a September that was in the driest ten percent of years. Unfortunately, aside from a few southern and southeastern counties that may receive some rain this weekend from the remnants of Hurricane Delta, there is very little indication that the rest of Indiana will receive above-normal precipitation throughout the rest of October.

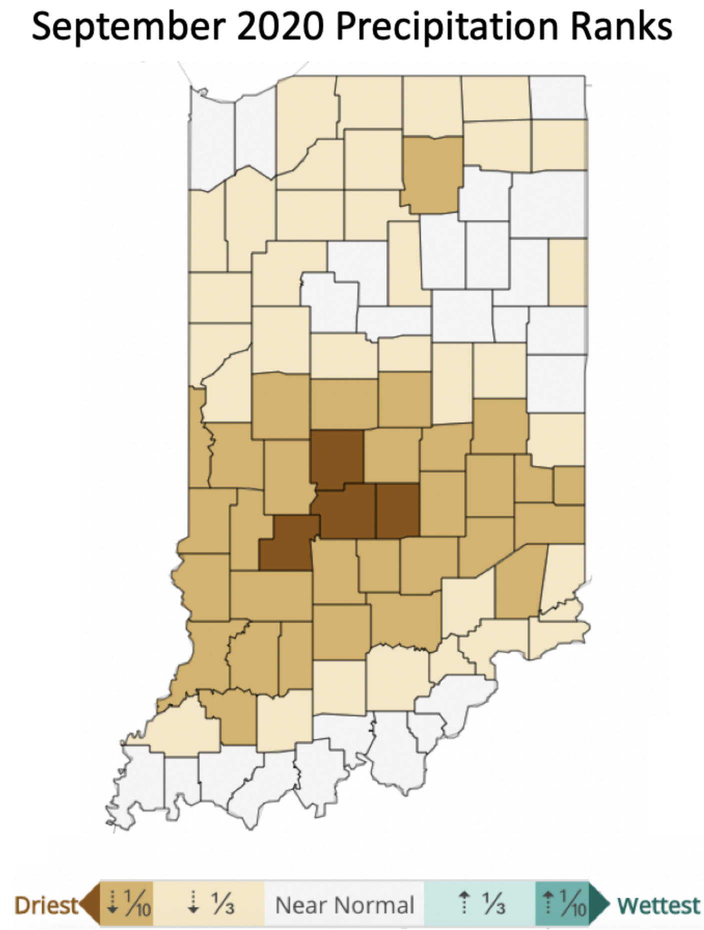


Figure 1. County ranks for September precipitation over the 1895 through 2020 period. Source: NOAA Climate At-A-Glance

The likelihood of a La Niña strengthening has been increasing in recent weeks. Historically, what this has meant for Indiana is a wetter winter (Figure 2). There is a bit of uncertainty with this prediction, however. First, while winters have been categorized as either El Niño, Neutral, or La Niña (phases of the El Niño – Southern Oscillation (ENSO) climate pattern) since the early 1950s, the number of those years that have fallen into those categories is relatively small. In other words, if this represents approximately 70 years of data, and one assumes a third of these years was either an El Niño, Neutral, or a La Niña winter, that leaves only about 23 years per category. Furthermore, those phases are labeled by their strength (*e.g.,* weak, moderate, or strong). If we assume that among those 23 years per phase, a third was either weak, moderate, or strong in its strength, then we are now only looking at about 8 years to draw a climatological conclusion on what a similar La Niña winter will look like in Indiana. Sadly, the climatological uncertainty does not stop there. Our climate has been changing significantly since the late 1970s. Therefore, the number of past years to use as guidance for this upcoming winter is even smaller. What can we glean from all of this? Climate scientists tend to agree that this coming winter is likely to be warmer than average (which has been a safe prediction most of the recent, past winters), and if it is going to be wetter, Indiana is likely to experience this closer to the end of the winter season, if not early spring – February and March. Will that increased wetness fall as rain or snow? Will it fall in fewer, heavier events or be spread evenly over those weeks? We'll leave those answers up to the weather forecasters who will be predicting three-to-seven days out!

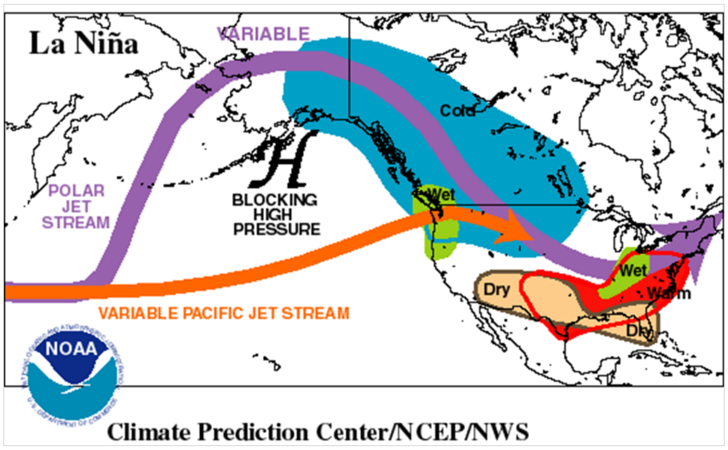
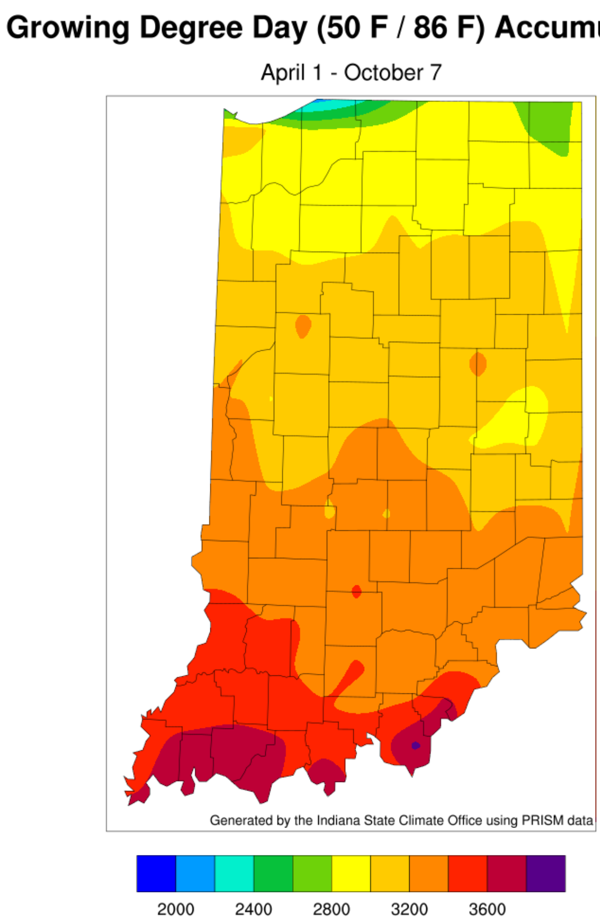


Figure 2. Typical winter season climate patterns associated with a La Nina.

Finally, as our major growing season comes to a close, Figures 3 and 4 provide the latest maps of accumulated modified growing degree days (mGDD). As of October 7, 2020, mGDDs in Indiana were slightly behind most of the past 5 years.

Figure 3. Modified accumulated growing degree-day units for April 1 – October 7, 2020.



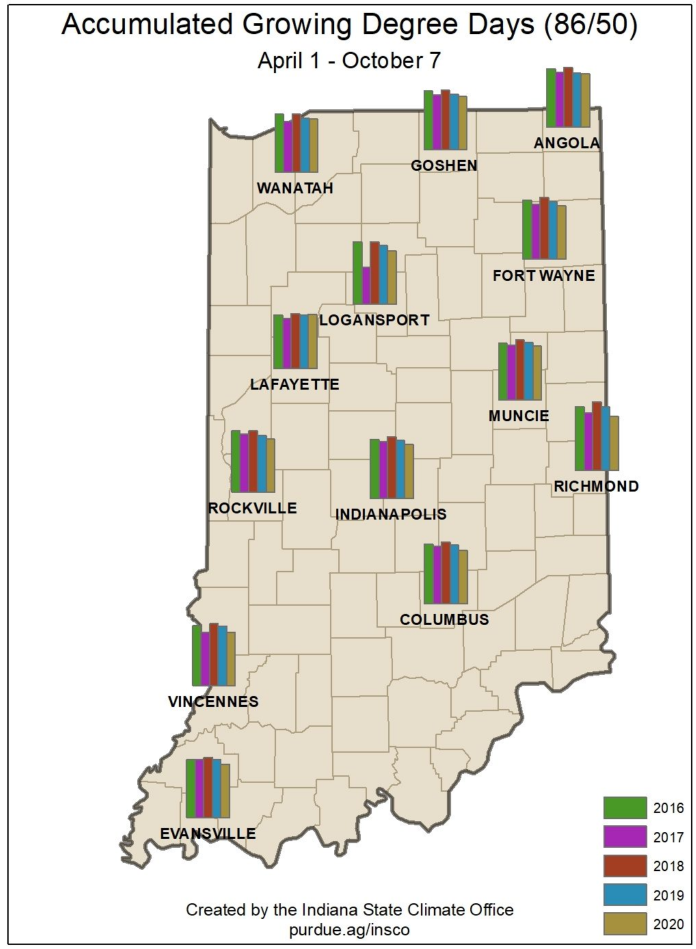


Figure 4. Comparison of accumulated modified growing degree days for April 1 through October 7 for 2016 through 2020.